CLAIMS

1. An enhanced electron field emission Spindt tip comprising:

a substrate;

a metal interconnect above the substrate to which a metal field emitter tip is affixed; and

successive dielectric and metal layers, each dielectric layer comprising a first dielectric sublayer and a second dielectric top layer, each dielectric layer having a dielectric aperture with a first horizontal dimension, the dielectric aperture having second-dielectric vertical walls and a second-dielectric collar, each metal layer having a metal aperture with a second horizontal dimension smaller than the first horizontal dimension, the metal-layers thicker near the apertures and thinner where the metal-layers overlie second dielectric top layers, the dielectric apertures and apertures coaxial with the metal field emitter tip.

2. The enhanced electron field emission Spindt tip of claim 1 further including a resistive heating layer between the substrate and the field emitter tip so that the metal field emitter tip is heated when current is passed through the resistive heating layer.

3. The enhanced electron field emission Spindt tip of claim 1 including two successive dielectric and metal layers, the first metal layer serving as an electron extraction anode and the second metal layer serving as a focusing lens cathode.

4. The enhanced electron field emission Spindt tip of claim 1 including three successive dielectric and metal layers, the two metal layers serving as an electron extraction anode and a focusing lens cathode, respectively, and the third metal layer serving to directionally control electrons emitted from the metal field emission tip.

5. The enhanced electron field emission Spindt tip of claim 1 including four successive dielectric and metal layers, the first two metal layers serving as an electron extraction anode and a focusing lens cathode, respectively, and the second two metal layers serving to directionally control electrons emitted from the metal field emission tip.

6. The enhanced electron field emission Spindt tip of claim 1 wherein the first dielectric is SiO_2 and the second dielectric is Si_3N_4.

7. A method for microfabricating an enhanced electron field emission Spindt tip, the method comprising:

providing a substrate;

depositing a first metal layer on the substrate and patterning the first metal layer to create an interconnect on the substrate;

creating a number of dielectric-bilayer/metal layers on top of the interconnect and substrate;

isotropically etching the number dielectric-bilayer/metal layers to create a cylindrical well; and

depositing a metal field emitter tip at the base of the cylindrical well on a surface of the interconnect.

8. The method of claim 7 wherein a thin-film resistive heating layer is deposited on the substrate and interconnect prior to creating the number of dielectric-bilayer/metal layers.

9. The method of claim 7 wherein the substrate is silicon having an SiO_2 surface layer.

10. The method of claim 7 wherein a dielectric-bilayer comprises an SiO_2 sublayer and an Si_3N_4 top layer.

11. The method of claim 7 wherein a dielectric-bilayer is created by:

depositing a first dielectric sublayer;

etching a tube-like slot in the first dielectric sublayer; and

depositing a second dielectric top layer on top of the first dielectric sublayer, filling the tube-like slot with second dielectric material.

12. The method of claim 11 wherein etching a tube-like slot further comprises:

applying a photoresist layer;

photolithographically patterning the photoresist layer to produce a photoresist mask; and

etching the first dielectric sublayer with a dielectric etching technique.

13. The method of claim 11 wherein the first dielectric sublayer is deposited by a plasma-enhanced chemical vapor deposition technique and the second dielectric sublayer is deposited by a low-pressure chemical vapor deposition technique.

14. The method of claim 7 wherein a metal layer is deposited on top of a dielectric-bilayer to form a dielectric-bilayer/metal layer.

15. The method of claim 7 wherein a metal layer is deposited by a vapor deposition technique.

16. The method of claim 7 wherein a metal layer is deposited by an evaporative deposition technique.

17 The method of claim 7 further including, following isotropically etching the number dielectric-bilayer/metal layers to create a cylindrical well, etching first dielectric material from the walls of the cylindrical well so that the walls of the cylindrical well comprise alternating rings of second-dielectric material and rings of metal.

18. An ultra-high density memory device employing an electron source comprising:

a substrate;

metal interconnects above the substrate to which metal field emitter tips are affixed; and

successive dielectric and metal layers, each dielectric layer comprising a first dielectric sublayer and a second dielectric top layer, the dielectric layer having a dielectric aperture with a first horizontal dimension and having second-dielectric vertical walls and a second-dielectric collar, each metal layer having a metal aperture, each metal aperture having a second horizontal dimension smaller than the first horizontal dimension, the metal-layers thicker near the apertures and thinner where the metal-layers overlie a second dielectric top layer, the dielectric apertures and metal apertures forming cylindrical wells coaxial with the metal field emitter tips.

19. A field emission display device employing an electron source comprising:

a substrate;

metal interconnects above the substrate to which metal field emitter tips are affixed; and

successive dielectric and metal layers, each dielectric layer comprising a first dielectric sublayer and a second dielectric top layer, the dielectric layer having a dielectric aperture with a first horizontal dimension and having second-dielectric vertical walls and a second-dielectric collar, each metal layer having a metal aperture, each metal aperture having a second horizontal dimension smaller than the first horizontal dimension, the metal-layers thicker near the apertures and thinner where the metal-layers overlie a second dielectric top layer, the dielectric apertures and metal apertures forming cylindrical wells coaxial with the metal field emitter tips.

20. An electron field emission Spindt tip heated by electrical resistance, the electron field emission Spindt tip comprising:

a substrate;

a metal interconnect deposited above the substrate, with an interconnect gap;

a thin-film resistive heating layer deposited over the substrate within the interconnect gap and over the interconnect ; and

a field emitter tip fabricated on the surface of the thin-film resistive heating layer within the interconnect gap that is heated by application of an electric current to the thin-film resistive heating layer.